NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

ALLEY CROPPING

(Ac.)

CODE 311

DEFINITION

This practice consists of trees or shrubs planted in a set or series of single or multiple rows with agronomic, horticultural crops or forages produced in the alleys between the rows of woody plants.

PURPOSE

This practice is used to achieve one or more of the following purpose(s):

- Produce tree and/or shrub products (wood, nuts, berries, fodder, mulch, etc.) along with crops or forages.
- Improve crop or forage quality and quantity by enhancing microclimatic conditions.
- Reduce surface water runoff and erosion.
- Improve utilization and recycling of soil nutrients.
- Reduce subsurface water quantity or alter water table depths.
- Provide or enhance wildlife habitat.
- Create habitat for biological pest management.
- Improve crop diversity, quantity, quality and economic returns.
- Decrease offsite movement of nutrients or chemicals.
- Enhance the aesthetics of the area.
- Increase carbon storage in plant biomass and soils.
- Improve air quality.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies on all lands where trees, shrubs, crops and/or forages can be grown in combination.

CRITERIA

Use the following criteria in planning and applying this practice. The general criteria apply to all alley cropping, while additional listed criteria may apply based on the intended purpose(s) of the practice.

General Criteria Applicable to All Purposes

Selecting Plant Species

Combinations of crops or forages and woody plants shall be compatible and complementary, and provide the products and crops that meet landowner objectives.

Plants shall be adapted to the climatic region and the soil resource, marketable, and suited to the landowner's equipment and management capabilities.

Crop or forage sequence and woody species selection shall be determined using an acceptable nutrient balance procedure. Select crops, forages and woody plants that maximize the utilization and recycling of soil nutrients, animal wastes and plant residues and that maintain soil organic matter content.

Moisture conservation or supplemental watering shall be provided for plant establishment and growth where natural precipitation is too low for the selected species.

Select crops or forages and woody plants with similar rooting depths and water requirements that do not exceed available soil water.

Select pest resistant plant varieties.

Avoid selecting tree or shrub species, which provide habitat to pests of the accompanying crop or forage.

Density and Spacing

Crops (woody and herbaceous) shall be grown in a planned conservation management system. The distance between the sets of trees or shrubs will be determined by the following tree or shrub management objectives:

- Light requirements and growth period of the crops or forages in the alleys.
- Erosion control needs.
- Machinery widths and turning areas.

Site Preparation and Planting

Avoid planting trees or shrubs where they will interfere with structures and above or below ground utilities.

Planting dates, care in handling, and planting the seed, seedlings, or cuttings will be accomplished to assure acceptable plant survival.

Only viable and high quality planting stock or seed will be used for establishing the tree or shrub rows.

Site preparation shall be sufficient for establishment and growth of selected species and appropriate for the site.

Other General Criteria

Soil erosion will be controlled by vegetative or other means until the alley cropping design is fully functional.

Comply with applicable federal, state and local laws and regulations, during the installation, operation (including product harvesting), and maintenance of this practice.

Note: Specific pesticide recommendations will be obtained from personnel who are licensed by the NC Department of Agriculture and Consumer Services in specialty area Agricultural Pest Plant Category O - in accordance with North Carolina Pesticide Laws and Regulations.
All pesticides must be registered for use by North Carolina and approved for use by the U. S. Environmental Protection Agency (EPA). Refer to the current issue of "North Carolina Agricultural Chemicals Manual" for guidelines, rules and regulations regarding use of pesticides. Users must **always** follow instructions and safety precautions on the container label when handling, applying, or storing pesticides.

Additional Criteria to Reduce Surface Water Runoff and Erosion

Tree or shrub rows will be oriented on or near the contour to reduce water erosion.

To reduce surface water runoff and erosion, herbaceous ground cover will be established in conjunction with the tree or shrub rows.

Selected species of trees and shrubs will be relatively deep rooted to encourage infiltration.

Use multiple rows of woody planting sets for enhanced reduction of surface water runoff and erosion where needed.

Additional Criteria to Provide of Enhance Wildlife Habitat

Woody species selection shall benefit targeted wildlife species. Design dimensions of the woody planting shall be adequate for targeted wildlife species.

Plan and use crop and forage management techniques (residue management, timing of mowing/harvest, etc.) in the alleys that will benefit wildlife target species.

Additional Criteria to Increase Carbon Storage in Biomass and Soils

Carbon sequestration is generally a secondary criterion for alley cropping. For optimal carbon sequestration, select woody plants (or mixtures of plants) that are adapted to the site to assure strong health and vigor. Plant the appropriate FULL stocking rate for the site and maximize the size (width and length) of the tree/shrub sets to fit the site. Some plants may fix carbon in biomass and soils more efficiently than others; consult current research on adapted plants that may sequester carbon more efficiently.

Prediction of carbon sequestration rates shall be made using current, approved carbon sequestration modeling technology.

Additional Criteria to Improve Air Quality

Use plant species (crop, forage) in the alley that provide full ground coverage during establishment and harvest operations.

Residue from the alley-crop shall be left on the surface. Select and maintain tree/shrub

species with foliar and structural characteristics that optimize interception, adsorption and absorption of particulates.

Tree or shrub rows will be oriented as close as possible to perpendicular to prevailing wind direction during the critical air period.

CONSIDERATIONS

Select crop, forage, tree and/or shrub varieties based on their tolerance to agriculture chemicals that will be used at the site.

Species diversity including use of native species should be considered to avoid loss of function due to species-specific pests or enhance wildlife needs.

Consider plant characteristics (rooting depths, growth pattern, etc.) of woody plantings and alley crops; where possible, choose planting sets that compliment each other (i.e. one growing while one dormant, one deep and one shallow rooted, etc.).

Crown expansion of woody plantings may eventually begin to shade alley areas and more shade resistant alley crops or forages may be required. If light demanding crops/forages are desired for more than 15 years, widen alleys to 40 feet or more.

High value trees or shrubs should be selected to maximize economic returns.

Consider cultural resources when planning this practice.

Anticipate possible off-site effects and modify the practice design accordingly.

Coppice ability of selected species of trees and shrubs should be considered when they are to be pruned periodically.

PLANS AND SPECIFICATIONS

Plans and Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

Minimum documentation for this practice includes:

- plant materials or species to be planted
- plant spacing and arrangement/width of crop/forage alleys and woody plantings
- site preparation and planting method(s) for woody planting rows
- site specific needs for soil amendments, cultural, pest management or other practices
- time or season of year to plant
- statement requiring compliance with all federal, state and local laws
- operation and maintenance requirements

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance).

- Replacement of dead trees or shrubs will be continued until the woody set is established. As a guide:
  - first 2 years: replace any dead plants
  - after 2 years: replace plants to maintain at least 85% survival, and not leave two adjacent dead plants.
- All other specified maintenance measures and techniques of tree/shrub establishment will continue until plant survival and establishment are assured. This includes pruning of dead or damaged branches for safety reasons, periodic pruning of selected branches for control of product quality, and control of undesirable competing vegetation.
- Inspect trees/shrub sets, crops, and/or forages periodically and protect from adverse impacts including insects, diseases or competing vegetation. Tree/shrub sets will be protected from fire and damage from livestock or wildlife.
- Removal of tree/shrub products, use of agricultural chemicals, and maintenance operations shall be consistent with the intended purpose of the practice. Avoid damaging the site and soil.

- Comply with applicable federal, state and local regulations pertaining to on-site and off-site effects.

REFERENECES

National Agroforestry Center, Lincoln NE. *Alley Cropping: An Agroforestry Practice.* Agroforestry Note # 12.

Buck, L.E. and Lassoie, J.P. 1998. *Agroforestry in Sustainable Agriculture Systems.*

Gordon, A.M. and Newman, S.M. 1997. *Temperate Agroforestry System.*

Kimble, J.M., Heath, Linda S., Birdsey, Richard A., Lal, R. editors. 2003. *The Potential of U.S. Forest Soils to Sequester Carbon and Mitigate the Greenhouse Effect.*